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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/821,478	03/29/2001	Hung Yip Ng	FIS9-2000-0192	5481

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EXAMINER

SAGAR, KRIPA

ART UNIT	PAPER NUMBER
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1756

DATE MAILED: 02/03/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

AS-8

Office Action Summary

Application No.

09/821,478

Applicant(s)

NG, HUNG YIP

Examiner

Kripa Sagar

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12 November 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☒ The proposed drawing correction filed on 12 November 2002 is: a) ☒ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Amendment

1. The amendment filed on 11/12/02 has been entered.
2. Claims 1,8 are amended; no new matter has been added. Claims 1-20 are under consideration.

Drawings

3. The proposed drawing correction and/or the proposed substitute sheets of drawings, filed on 11/12/02 have been approved. A proper drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The correction to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Pat. 6174818 to Tao et al. in view of US Pat. 5783101 to Ma et al. and further in view of US Pat. 6297166 to Horak et al.

The invention discloses a method of compensating for nested-to-isolated pattern bias. Positive bias is compensated for by adding a sputtering component to the etch

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chemistry, while negative bias is adjusted for by the electrical bias on the substrate ("space charge" effect).

The instant claims recite providing a structure with a first critical dimension (CD) and lithographically reducing the CD by an O₂-containing trimming etch. The claims further recite correcting the CD-bias between nested and isolated features during a plasma-etch and the etching parameters for the process.

Tao teaches a method of narrowing gate electrodes on a device. The steps comprise (a) forming a stack layer and patterning the photoresist, (b) optionally trimming the resist pattern (c) etching the anti-reflection coating (ARC) and hardmask and trimming the hard mask to a sub-lithographic dimension (if not trimmed by the photoresist) and (d) etching the gate to the desired sub-lithographic dimension. These are shown in Figs. 2-6. Tao uses an O₂-containing gas in the plasma etching process (3;43-52). Tao teaches a method of narrowing gate electrodes on a device. The steps comprise (a) forming a stack layer and patterning the photoresist, (b) optionally trimming the resist pattern (c) etching the anti-reflection coating and hardmask and trimming the hard mask to a sub-lithographic dimension (if not trimmed by the photoresist) and (d) etching the gate to the desired sub-lithographic dimension. These are shown in Figs. 2-6. Tao uses an O₂-containing gas in the plasma etching process (3;43-52). Tao discloses that the use of NF₃ as an etchant species is known in prior art(1;52-58)

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It does not teach correcting for the CD-bias, the magnitude of the correction or the etching parameters used. It does not specify positive or negative resists. Tao's layers include an oxide layer and an ARC but do not contain TEOS.

Ma teaches that CD-bias or "profile microloading" is known in prior art (1;60-2;21). The prior-art process corrects for the microloading effect by adjusting the RF power (and hence the space charge). Note that the resist sputtering effect is also adjustable by adjusting the frequency of the RF power (2;32-64). Ma's invention discloses further adjusting the etch parameters to correct for the CD bias. These include lowering the frequency (Fig.5) and increasing the RF power (3;10-27). The system is operated at 0-100mT (5;45-49).

Ma does not specify positive or negative photoresists (claims 2,4) or the extent of lateral trimming (claim 5) by the etch.

The choice of the photoresist and the adjustment of the trim are uniquely determined by the process. These are based on empirical data and process control techniques instituted on the manufacturing line. This is also taught by Horak who provides the concept for trimming the resist and ARC (anti-reflective coating) to compensate for the nested-isolated *etching bias* of the gate (6;49-7;44). It teaches that nested-iso *print bias* is also corrected by this process (7;45-67). The etch chemistries are adjusted between the sputtering and etching species to bring about the variable etch rates (fig.5-8).

Horak, Ma and Tao solve the problem of etch bias and attempt to form narrow gates with consistent CDs. It would have been obvious to one of ordinary skill in the art

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at the time the invention was made to compensate for the etch bias of nested and isolated lines by biasing the etch-masks, as taught by Horak, using the teachings of Ma and Horak to set the etching parameters in Tao's trimming process because Ma teaches that varying the above mentioned parameters reduces microloading and increases the process window (3;15-27) while Horak teaches that this facilitates the design process for producing consistent products (2;45-65).

Response to Arguments

6. Applicant's arguments filed 11/12/02 have been fully considered but they are not persuasive.

Applicant has argued that (a) Tao does not teach compensating for the nested-iso bias and (b) that Ma's teachings are directed to an unrelated problem and hence it is not obvious to combine with Tao's teachings and (c) Ma does not teach compensating for nested-iso bias and hence the combination of Tao and Ma would not produce the claimed invention.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Both Ma and Tao address the problem of CD-bias during etching. Ma further teaches the concept of microloading in dense patterns and the prior art efforts to minimize microloading. These were clearly indicated in the prior rejection.

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The arguments are further refuted by Horak which teaches biasing the mask-etch to bring about consistent gate widths in dense and sparse regions.

Conclusion

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kripa Sagar whose telephone number is 703-605-4427. The examiner can normally be reached on 8:00AM--5:00PM (M-F).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark F Huff can be reached on 703-308-2464. The fax phone numbers for

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the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

A handwritten signature in black ink, appearing to read 'Mark F. Huff', with a long horizontal flourish extending to the right.

MH/ks
January 21, 2003

MARK F. HUFF
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700